



GE VERNOVA

# DEMYSTIFY GRID ORCHESTRATION SOFTWARE:

How GridOS<sup>®</sup> can help tackle the toughest grid modernization challenges

GridOS<sup>®</sup> Orchestration  
Software

# CONTENTS



Introduction



CHAPTER 1

Keep the lights on



CHAPTER 2

Facilitate the energy transition



CHAPTER 3

Accelerate modernization



CHAPTER 4

Shield against cyberattacks



CHAPTER 5

Manage culture change



CONCLUSION

What's next for utilities?





# INTRODUCTION

## ACCELERATE GRID MODERNIZATION WITH ORCHESTRATION TECHNOLOGY

When it comes to grid modernization, the clock is ticking.

The grid has reached an inflection point due to growing renewables penetration, electrification, and more frequent and severe disruption events like storms, wildfires and the like. Prosumers are also appearing in increasing numbers, giving the grid an omnidirectional flow that adds complexity. Without new technology, the grid will soon become a bottleneck in the transition to clean energy. Customers will see the reliable, resilient grid they have come to expect grind to a halt, opening the door for costly, risky interruptions.

Indeed, a recent report by Gartner Research encouraged utilities to “consider acquiring or building a digital platform business that will orchestrate diverse, flexible resources across external participants, such as virtual power plants, aggregators and customers” as part of a modern approach to doing business in the current energy environment.

### THE TIME TO ACT IS NOW.

Source: 2023 Utility Trend: Utility Business Models Are Evolving From 'Ego-Centric' to Eco-Centric



# LET'S LOOK AT HOW YOU CAN CONQUER SOME OF THE TOUGHEST GRID MODERNIZATION CHALLENGES WITH GridOS:

**GridOS** is the key to preventing bottlenecks to grid modernization. The first software portfolio designed specifically for grid orchestration, GridOS provides the modern software to orchestrate the complexity that comes with a sustainable energy grid while delivering a reliable and resilient network. The robust solutions that make up our portfolio directly address the most critical challenges utilities face in transitioning to a sustainable energy grid, from keeping the lights on to addressing the graying of the workforce.

GridOS also brings together strategic cloud computing and solution integration partners to help utilities optimize performance and Accelerate reliable and secure grid modernization projects.

accenture

aws

Infosys®

pwc



01

# KEEP THE LIGHTS ON

Keeping the lights on for consumers can feel like a competitive sport for the modern grid operator. The complexity of supplying electricity during the transition to cleaner energy sources means utilities have their work cut out for them. Luckily, GridOS can help address the challenge of keeping power flowing during the shift to clean energy.

**18%**

GE Vernova Grid Software customers experience 18% less network outages

**40%**

GE Vernova Grid Software customers realize 40% faster restoration times

DISCLAIMER: Data source from [Annual Electric Power Industry Report, Form EIA-861, October 2022](#), results based on utilities in the United States that have 1.25 million customers or more. Reliability data reflects average SAIDI and SAIFI with MEDs.

CHAPTER 1  
Keep the lights on

CHAPTER 2  
Facilitate the energy transition

CHAPTER 3  
Accelerate modernization

CHAPTER 4  
Shield against cyberattacks

CHAPTER 5  
Manage culture change

CONCLUSION  
What's next for utilities?



# HERE'S WHAT GridOS CAN DO TO **KEEP THE LIGHTS ON:**

**1** Protect against  
disruption events

**2** Simplify renewables  
penetration

**3** Tear down  
transmission and  
distribution silos

**4** Keep costs  
under control

“Storm of the century?” How about “storm of tomorrow?” Every year the number of severe storms increases due to global warming. Wildfires grow bigger. Heat waves become, well – hotter – and longer. It’s time to stop scrambling to restore power in the wake of disruptions like these and take a more proactive approach to disruption management.

The GridOS portfolio includes an application called Disruption Readiness. It combines weather and outage history data to accurately forecast the impact of weather on the network and safely prepare response crews. When you can predict up to 72 hours in advance the number of outages and their location, you can proactively dispatch your field response crews and avoid the costs (and risks) associated with moving them during events.

A utility in the US **avoided over 150M of Customer Minutes of Interruption** annually and over \$175M of Interruption Cost Estimates in one year by using **GE Vernova’s Grid Software.**

Source: Alabama Power FISR implementation



# HERE'S WHAT GridOS CAN DO TO **KEEP THE LIGHTS ON:**

**1** Protect against  
disruption events

**2** Simplify renewables  
penetration

**3** Tear down  
transmission and  
distribution silos

**4** Keep costs  
under control

The modern grid is composed of an increasing number of renewables. The more renewables, the greater the complexity and unpredictability of power – simply because the wind doesn't always blow and the sun doesn't always shine. GridOS's Advanced Energy Management System (AEMS) can regulate the flow of electrons across distribution, transmission, and the edge, ensuring reliable, resilient electrical supply despite intermittent (and omnidirectional) power flow from renewables.

**AEMS Platform** can make an **auto-restoration plan in less than 10 seconds** for an area covering 3.5 million people.

Disclaimer: Data based on a single demonstration project - PG&E in US.



# HERE'S WHAT GridOS CAN DO TO **KEEP THE LIGHTS ON:**

**1** Protect against disruption events

**2** Simplify renewables penetration

**3** Tear down transmission and distribution silos

**4** Keep costs under control

Transmission and distribution operators often work in silos, with little communication between the two. This can cause several grid-threatening issues like unnecessary competition for resources, clashing priorities, and, worst of all, a lack of access to data that could help resolve system-wide issues.

GridOS changes that via a federated grid data fabric with a common transmission and distribution network model. A federated data model consolidates two or more separate databases into one, breaking down data silos and improving visibility. Having access to both transmission and distribution data makes it possible to model the grid for simulations, predictive operations, and automated grid control.

**AEMS Platform** can make an **auto-restoration plan in less than 10 seconds** for an area covering 3.5 million people.

Disclaimer: Data based on a single demonstration project - PG&E in US.





# HERE'S WHAT GridOS CAN DO TO **KEEP THE LIGHTS ON:**

**1** Protect against  
disruption events

**2** Simplify renewables  
penetration

**3** Tear down  
transmission and  
distribution silos

**4** Keep costs  
under control

Many of the costs of running a grid are completely avoidable, from inertia management to mobilizing too many resources before a storm. GridOS leverages AI and machine learning to analyze current and historical data to determine how grid operators can reduce avoidable costs. An example could be drawing on distributed energy resources (DERs) to quickly balance low inertia, thereby reducing inertia management costs.

For large grids with high renewables penetration, it is possible to **avoid up to 40% of inertia management costs.**

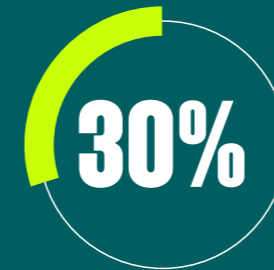
Disclaimer: Data based on a single demonstration project - NG ESO in UK. Results may vary based on utility's generation mix.



02

# FACILITATE THE ENERGY TRANSITION

The energy transition is the number-one driver of the need for orchestration software. Government regulations, organizational commitments (think corporate sustainability) and consumer expectations around renewable energy call for new technologies. There's a crucial need for software that can keep electricity flowing while grids transition to sustainable energy sources.



30%  
of the world's electricity is  
generated with the help  
of GE technology

Source: [2022 GE Sustainability Report](#)

CHAPTER 1  
Keep the  
lights on

**CHAPTER 2**  
**Facilitate the  
energy transition**

CHAPTER 3  
Accelerate  
modernization

CHAPTER 4  
Shield against  
cyberattacks

CHAPTER 5  
Manage culture  
change

CONCLUSION  
What's next  
for utilities?



# HERE'S WHAT GridOS CAN DO TO FACILITATE THE ENERGY TRANSITION:

**1** Crush Net Zero objectives

**2** Seamlessly integrate DERs

**3** Get a crystal-clear view of the network

**4** Simplify data access and utilization

Every utility is focused on reaching Net Zero carbon emissions. Doing so requires increasing renewables integration – and successfully managing the complexity that comes with it. Without grid orchestration software, utilities will be forced to curtail renewables due to line capacity issues. GridOS enables hitting Net Zero objectives by quickly, securely, and effectively incorporating renewables into the grid. From there it's easier to visualize and proactively manage these assets.

**Renewables** are expected to account for **over 90% of global electricity expansion.**

Source: [International Energy Agency](#)



# HERE'S WHAT GridOS CAN DO TO FACILITATE THE ENERGY TRANSITION:

1 Crush Net Zero objectives

2 Seamlessly integrate DERs

3 Get a crystal-clear view of the network

4 Simplify data access and utilization

Every utility experiences two challenges due to millions of new DERs entering the market every year. The first is securely connecting those DERs to the grid. The second is managing the DERs' omnidirectional electrical flow to and from prosumers. A modern grid needs new capabilities to balance and regulate the flow of electricity to and from DERs. GridOS can facilitate that via an integrated, modular, standards-based, and scalable DER management system (DERMS) platform. GridOS DERMS provides grid operators with a suite of tools to connect, visualize, control, and optimize DERs from both a technical and economic standpoint. These end-to-end tools help improve grid reliability and resiliency, ensure regulatory compliance, and enable energy affordability and customer participation in grid modernization.

**Renewables** are expected to account for **over 90% of global electricity expansion.**

Source: [International Energy Agency](#)



# HERE'S WHAT GridOS CAN DO TO FACILITATE THE ENERGY TRANSITION:

**1** Crush Net Zero objectives

**2** Seamlessly integrate DERs

**3** Get a crystal-clear view of the network

**4** Simplify data access and utilization

With so many varied sources of electricity and directions of flow, grid operators need a single, unified view of their entire network. GridOS provides “network modeling,” providing grid operators with just that – visibility, accuracy and insight into where and how each asset plugs into the grid. This interface helps to manage and efficiently operate an end-to-end network.

**Renewables** are expected to account for **over 90% of global electricity expansion.**

Source: [International Energy Agency](#)



# HERE'S WHAT GridOS CAN DO TO FACILITATE THE ENERGY TRANSITION:

**1** Crush Net Zero objectives

**2** Seamlessly integrate DERs

**3** Get a crystal-clear view of the network

**4** Simplify data access and utilization

Unlocking grid orchestration requires fast and easy access to energy data. But this is easier said than done. Energy data is now bigger, faster, more disparate, and more scattered than ever before, all of which make it notoriously difficult to access and leverage. Part of the GridOS platform is GridOS Data Fabric – a federated data management layer that makes it quicker and easier to eliminate data silos and visualize, govern, and utilize the right data for intelligent grid decision making by operators or applications. With GridOS Data Fabric, utilities have the data they need to unlock advanced grid orchestration use cases and the power of AI/ML, right at their fingertips.

**Renewables** are expected to account for **over 90% of global electricity expansion.**

Source: [International Energy Agency](#)



03

# ACCELERATE MODERNIZATION



The longer grid operators wait to modernize, the closer they get to that zero hour where the grid becomes a bottleneck. GridOS is all about speed, scalability, and agility, ensuring that transformation happens quickly, yet securely.



90%  
of the world's power  
transmission utilities  
are equipped with  
GE technology

Source: 2022 GE Sustainability Report

CHAPTER 1  
Keep the  
lights on

CHAPTER 2  
Facilitate the  
energy transition

CHAPTER 3  
**Accelerate  
modernization**

CHAPTER 4  
Shield against  
cyberattacks

CHAPTER 5  
Manage culture  
change

CONCLUSION  
What's next  
for utilities?



# HERE'S WHAT GridOS CAN DO TO ACCELERATE GRID MODERNIZATION:

**1** Introduce automation

**2** Integrate existing systems

**3** Deploy at top speed

Automation is a critical part of grid modernization, involving replacing or augmenting manual processes with processes guided by software, data, and technology. GridOS and its associated solutions add automation to many grid-management processes, such as load frequency control and voltage management.

GridOS **deployment automation** unlocks system updates, **saving significant time and expense** over costly, lengthy upgrades.





# HERE'S WHAT GridOS CAN DO TO ACCELERATE GRID MODERNIZATION:

1 Introduce automation

2 Integrate existing systems

3 Deploy at top speed

Grid modernization must take existing infrastructure, solutions and systems into account, especially from a software perspective. GridOS leans on strategic partners like AWS, Infosys, PwC and Accenture to help integrate existing systems and solutions into the newer, modernized sustainable energy grid. They can also greatly assist with the culture change needed to implement the new software. GridOS certification will help utilities move even faster on their grid modernization journey.

GridOS **deployment automation** unlocks system updates, **saving significant time and expense** over costly, lengthy upgrades.



# HERE'S WHAT GridOS CAN DO TO ACCELERATE GRID MODERNIZATION:

**1** Introduce automation

**2** Integrate existing systems

**3** Deploy at top speed

The timeline for grid modernization is accelerating. This makes deployment times a key factor for consideration when launching any new grid software. GridOS leverages standardized, automated deployment models to enable quicker system builds and time to value. This ensures grid operators begin reaping ROI as soon as possible. It's a similar story for updates, which can happen in mere weeks, not years.

GridOS **deployment automation** unlocks system updates, **saving significant time and expense** over costly, lengthy upgrades.



# SHIELD AGAINST CYBERATTACKS

The electrical grid is more exposed to cyberthreats because of the increase in connected technology, convergence of IT/OT, cloud services, and mobile workforces. As a result, this is becoming a national security concern. Cyberthreats can come from either inside or outside the grid, whether to stop the flow of power and hold it for ransom, or to shut it down long term as an act of terrorism or war.

**~1,100**  
**CYBERATTACKS**  
Per week on the grid

**48% ↑**  
in cyberattacks on the grid YOY 2021 to 2022

Source: [Check Point Research](#)



New, modern protections are needed to secure the grid from cyberthreats. A Zero Trust grid security model, like the one built into GridOS, provides the level of protection needed by the new, digitized grid, ensuring alignment to standards and growth in the grid's scale potential. **It addresses network challenges by establishing strong security controls on these three key pillars:**

**1** Users

**2** Technology

**3** Software

Zero Trust grid security principles verify identities by authenticating users via multifactor authentication (MFA) or time based one-time password (TOTP). Additional layers of security come from disallowing password and username sharing, as well as enabling federated ID management (leveraging identity provider as a trusted source for user IDs).

A Zero Trust grid security model can shield utilities from various attacks, including:

- **Ransom attacks:** One of the most common cyberthreats to the grid. Involves internal or external hackers shutting down the grid and holding it for ransom.
- **Terror attacks:** Terrorist groups may seize and/or damage the grid to the point that it can no longer supply power.
- **Warfare:** The war in Ukraine has shown that cyberattacks are the next frontier of modern warfare. Russian hackers have launched numerous attacks against Ukrainian infrastructure – especially the power grid.



New, modern protections are needed to secure the grid from cyberthreats. A Zero Trust grid security model, like the one built into GridOS, provides the level of protection needed by the new, digitized grid, ensuring alignment to standards and growth in the grid's scale potential. **It addresses network challenges by establishing strong security controls on these three key pillars:**



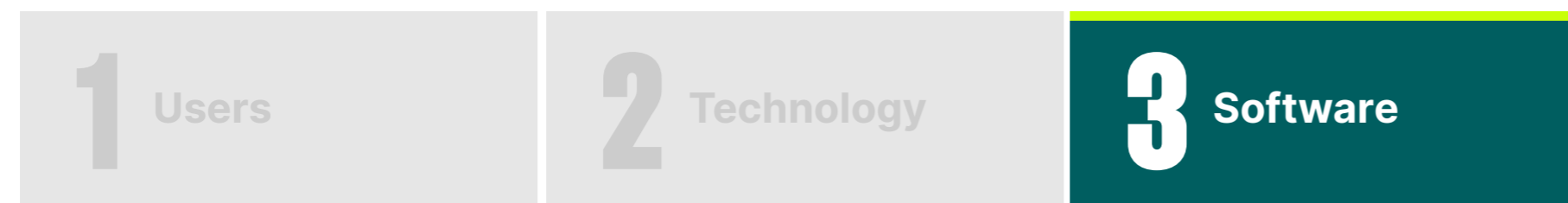
Zero Trust grid security principles employ standard communication protocols, so all security parameters are known. The model mandates all communications are encrypted even if they are internal. Zero Trust grid security principles also have strict role-based access control (RBAC) triggers and also limit session concurrency, time, and inactivity. Finally, Zero Trust grid security principles only accept traffic from known clients, based on the IP and certificate.

A Zero Trust grid security model can shield utilities from various attacks, including:

- **Ransom attacks:** One of the most common cyberthreats to the grid. Involves internal or external hackers shutting down the grid and holding it for ransom.
- **Terror attacks:** Terrorist groups may seize and/or damage the grid to the point that it can no longer supply power.
- **Warfare:** The war in Ukraine has shown that cyberattacks are the next frontier of modern warfare. Russian hackers have launched numerous attacks against Ukrainian infrastructure – especially the power grid.



New, modern protections are needed to secure the grid from cyberthreats. A Zero Trust grid security model, like the one built into GridOS, provides the level of protection needed by the new, digitized grid, ensuring alignment to standards and growth in the grid's scale potential. **It addresses network challenges by establishing strong security controls on these three key pillars:**



A Zero Trust grid security model leverages a mutual Transport Layer Security (TLS) protocol, a method for mutual authentication, to ensure the connectivity to software applications is secured with a key. Additionally, RBAC policies and full encryption provide secure application connections. Preventive areas for software and applications in the Zero Trust grid security model ensure software bills of materials (SBOMs) are verified, and the update cadence is consistent with patches and enhancements.

A Zero Trust grid security model can shield utilities from various attacks, including:

- **Ransom attacks:** One of the most common cyberthreats to the grid. Involves internal or external hackers shutting down the grid and holding it for ransom.
- **Terror attacks:** Terrorist groups may seize and/or damage the grid to the point that it can no longer supply power.
- **Warfare:** The war in Ukraine has shown that cyberattacks are the next frontier of modern warfare. Russian hackers have launched numerous attacks against Ukrainian infrastructure – especially the power grid.



05

# MANAGE CULTURE CHANGE

Anytime new software comes into the scene, people wonder how it will impact their jobs. What needs to be understood is that grid orchestration software transforms jobs – and workplaces – for the better.

At least

**50%**

of the current  
utility workforce will  
**retire within the  
next 10 years**

Source: [US Department of Labor](#)

CHAPTER 1  
Keep the  
lights on

CHAPTER 2  
Facilitate the  
energy transition

CHAPTER 3  
Accelerate  
modernization

CHAPTER 4  
Shield against  
cyberattacks

**CHAPTER 5**  
**Manage culture  
change**

CONCLUSION  
What's next  
for utilities?



# HERE'S WHAT GridOS CAN DO TO HELP TRANSFORM THE WORKPLACE FOR THE BETTER:

**1** Improve the work experience

**2** Optimize crossfunctional communication

**3** Create new, cutting-edge jobs

**4** Attract fresh talent

Grid orchestration software augments jobs with technology and automation, simplifying tasks that may have once been seen as tedious, imprecise, or challenging. Think about the inexact science of deciding how many power-restoration units to mobilize in the wake of a storm. Too few and customers lose power for an unnecessarily long time; too many and it's seen as wasteful. Grid analytics, a key component of GridOS, can predict with high accuracy the impact of an incoming storm. In addition, it can determine the right number of resources to mobilize and how to best distribute them.





# HERE'S WHAT GridOS CAN DO TO HELP TRANSFORM THE WORKPLACE FOR THE BETTER:

**1** Improve the work experience

**2** Optimize crossfunctional communication

**3** Create new, cutting-edge jobs

**4** Attract fresh talent

Grid orchestration software can also help improve working relations. Traditionally, for example, transmission and distribution teams are siloed and hyper focused on their own remits. GridOS can help break down silos and get transmission and distribution teams collaborating more. The software orchestrates the electrical flow across the entire grid, not just one sector. This opens up oncesiloed data sources that can be used to model the grid for simulations and other essential operations.



# HERE'S WHAT GridOS CAN DO TO HELP TRANSFORM THE WORKPLACE FOR THE BETTER:

**1** Improve the work experience

**2** Optimize crossfunctional communication

**3** Create new, cutting-edge jobs

**4** Attract fresh talent

New software creates new opportunities – job opportunities, that is. It's well known that the utility and power industries face a tight labor market. Digitization brings with it new opportunities for software operation and oversight, providing new opportunities for employees who may want a more challenging role. This keeps employee retention and satisfaction high.



# HERE'S WHAT GridOS CAN DO TO HELP TRANSFORM THE WORKPLACE FOR THE BETTER:

**1** Improve the work experience

**2** Optimize crossfunctional communication

**3** Create new, cutting-edge jobs

**4** Attract fresh talent

The current young talent pool is tech-obsessed. GridOS, the world's first grid software portfolio designed for grid orchestration, opens new doors to attract talent that is eager to work with the latest cutting-edge software. As a bonus, GridOS supports grid modernization and the effort to decarbonize the planet - meaning those younger workers have something to be proud of.



# WHAT'S NEXT FOR UTILITIES

Grid orchestration software is truly the way of the future for utilities, no matter where they are on the complex path to grid modernization. With the world's first software portfolio designed for grid orchestration, grid operators can keep power flowing while they make the complex transition to sustainable energy sources, setting themselves, and the world up for success.



This pioneering tool will improve the ESO's ability to manage system stability across the entire network as more renewable energy sources connect to the grid."

**Julian Leslie**

Head of Networks, National Grid ESO

**STEDIN**<sup>.NET</sup>

Learn how **Stedin** uses GE Vernova Grid Software to **manage power flow from a variety of DERs**, ensuring flexibility and reliability at all times.

[Learn more](#)

**nationalgrid**ESO

Discover how **National Grid ESO** deployed GE Vernova Grid Software to **regulate inertia** for maximum efficiency and cost savings.

[Learn more](#)





GridOS<sup>®</sup> Orchestration  
Software

# LEARN MORE ABOUT WHAT GRID ORCHESTRATION SOFTWARE CAN DO FOR YOU

Get in touch

📞 1-833-690-5552